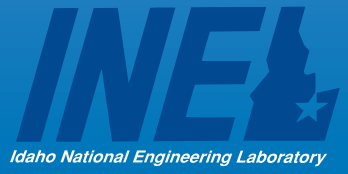
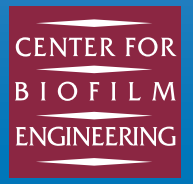
Biodecontamination For D & D





VG95 0100

Phase 2
Process
Initiation

Phase 3
Process
Maintenance

Phase 1
Application

Phase 4
Process
Termination
+ Waste
Removal

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Problem Definition

- **Extensive contamination of concrete structures**

1000 facilities in DOE decommissioning

$ tens of billions decommissioning liabilities in the U.S.

$21 billion decommissioning liabilities in the U.K.

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Current Baseline Technologies

- Are labor intensive
- Are costly
- Pose health risks
- Result in large volumes of waste

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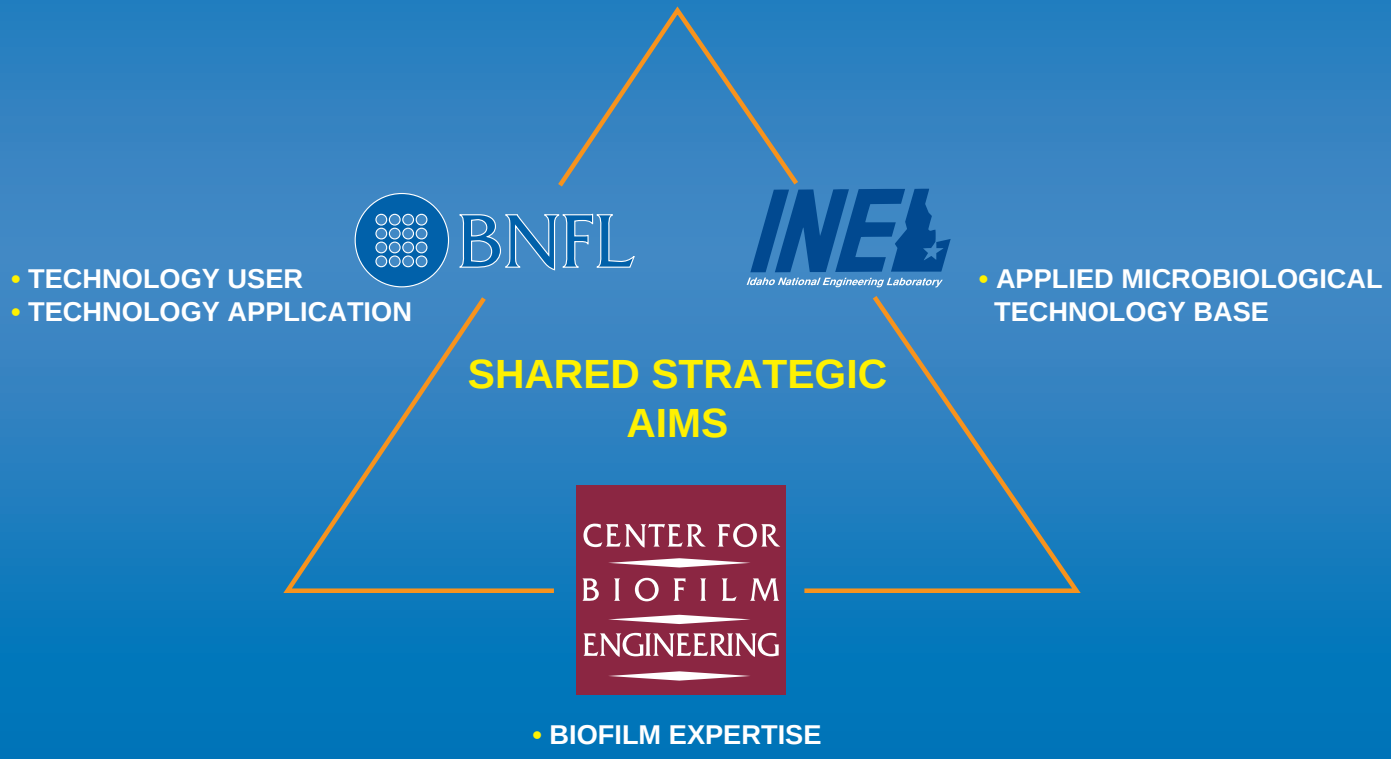
A Solution

Technology Alternative Biodecontamination



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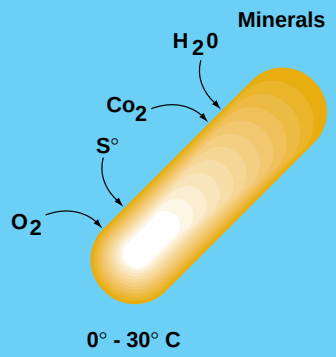
Advantages to Biodecontamination

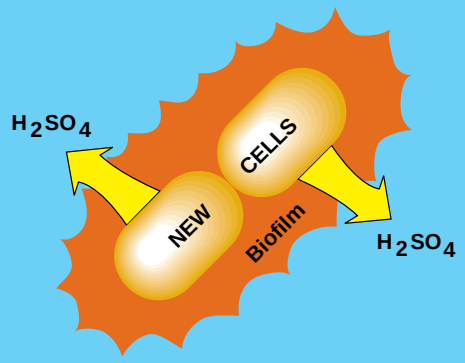
- Cost savings
- Waste volume minimization
- Contamination containment
- Utilizes waiting period
- Accesses entire surface regardless of geometry
- Safe, Natural process
- Reduced man entry and radiation exposure

Life Requirements



0° - 30° C

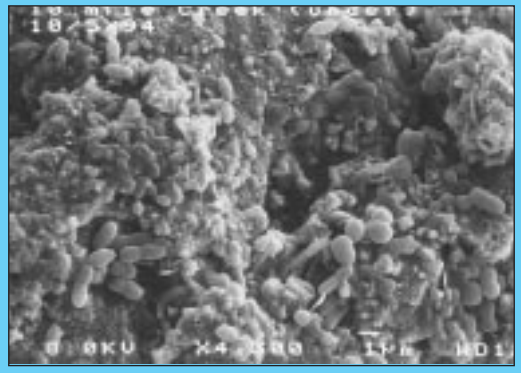
Metabolic Products



Thiobacilli sp
1μm x 0.5μm

Aerobic Autotroph
non-pathogenic
ubiquitous in environment
not genetically engineered

SEM



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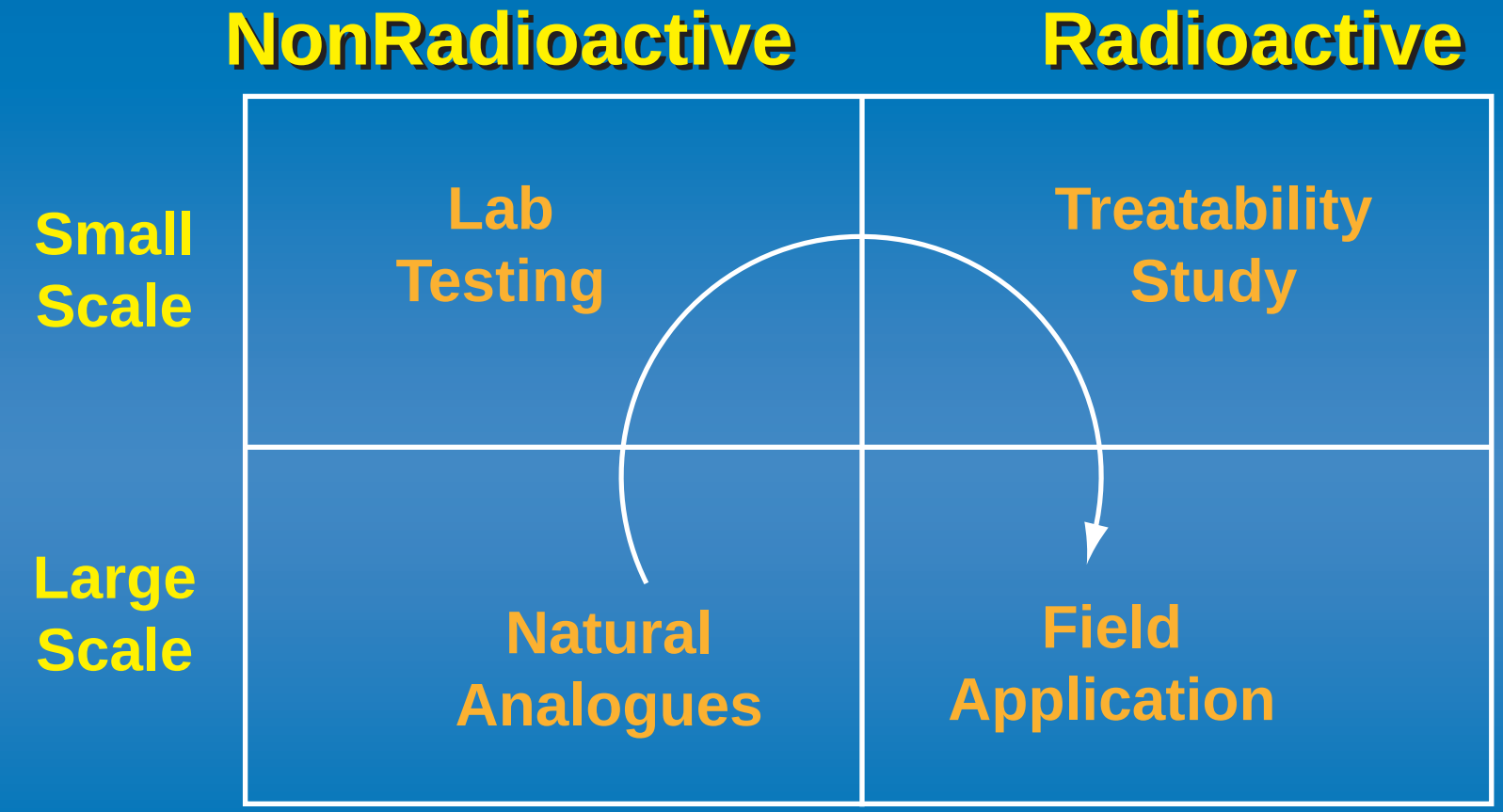

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Natural Analogues

Bureau of Mines

NRC

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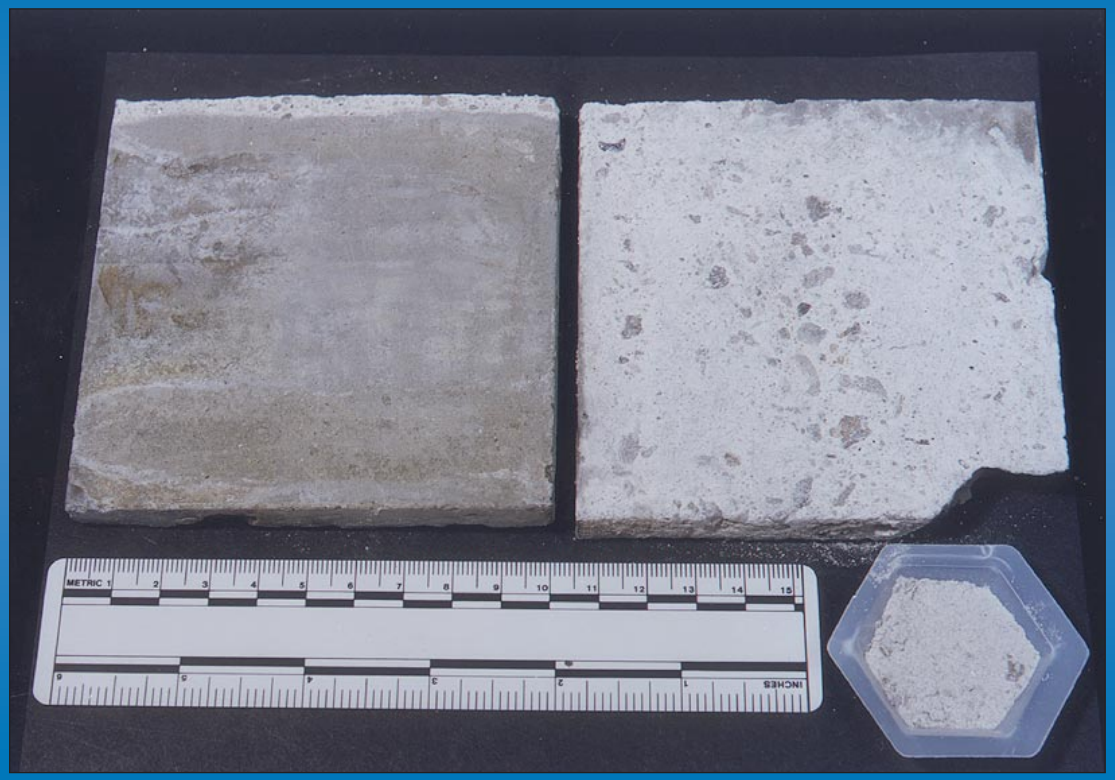
Lab Testing

SDLR Project



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Treatability Study

LDRD Funding FY95

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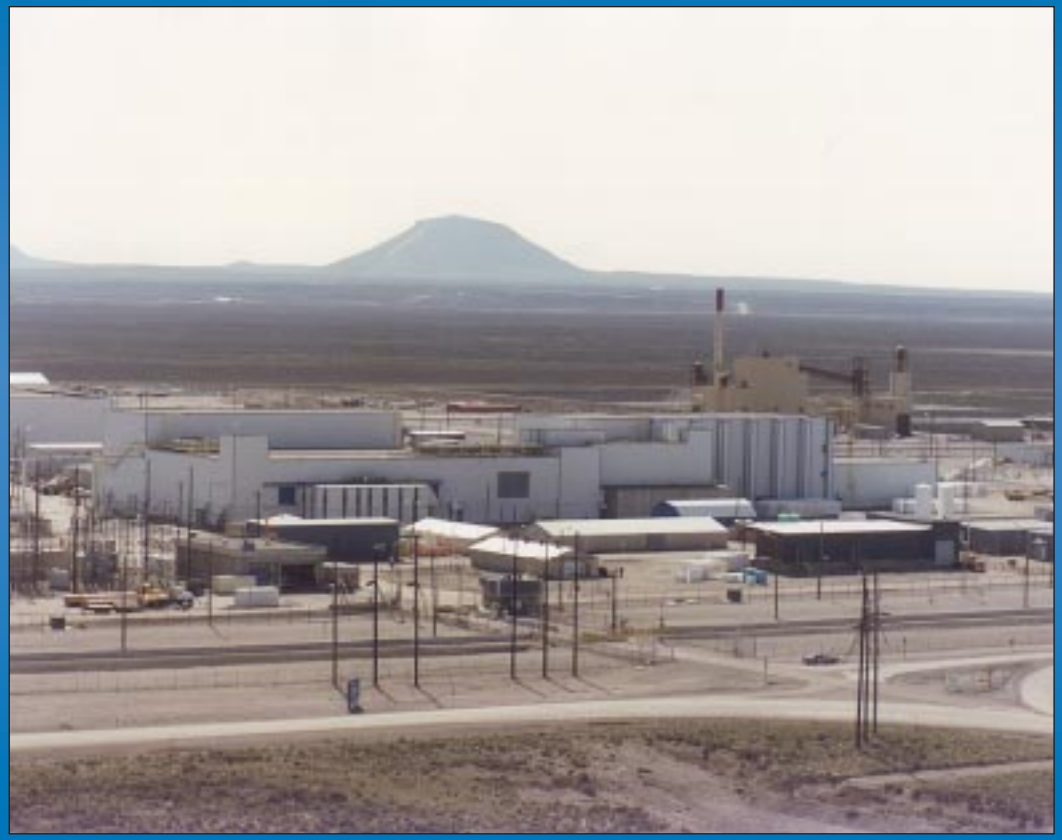
Field Application

Chemical Processing Plant at INEL



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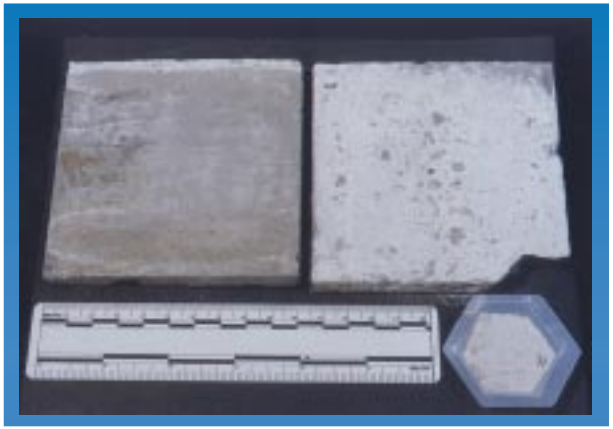
NonRadioactive Radioactive

Small Scale

Large Scale



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Phase 2
Process
Initiation

Phase 3
Process
Maintenance

Phase 1
Application

Phase 4
Process
Termination
+ Waste
Removal

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Development Needs

- Define process time requirements
- System optimization
- Expand application
- Design and conduct field demonstration

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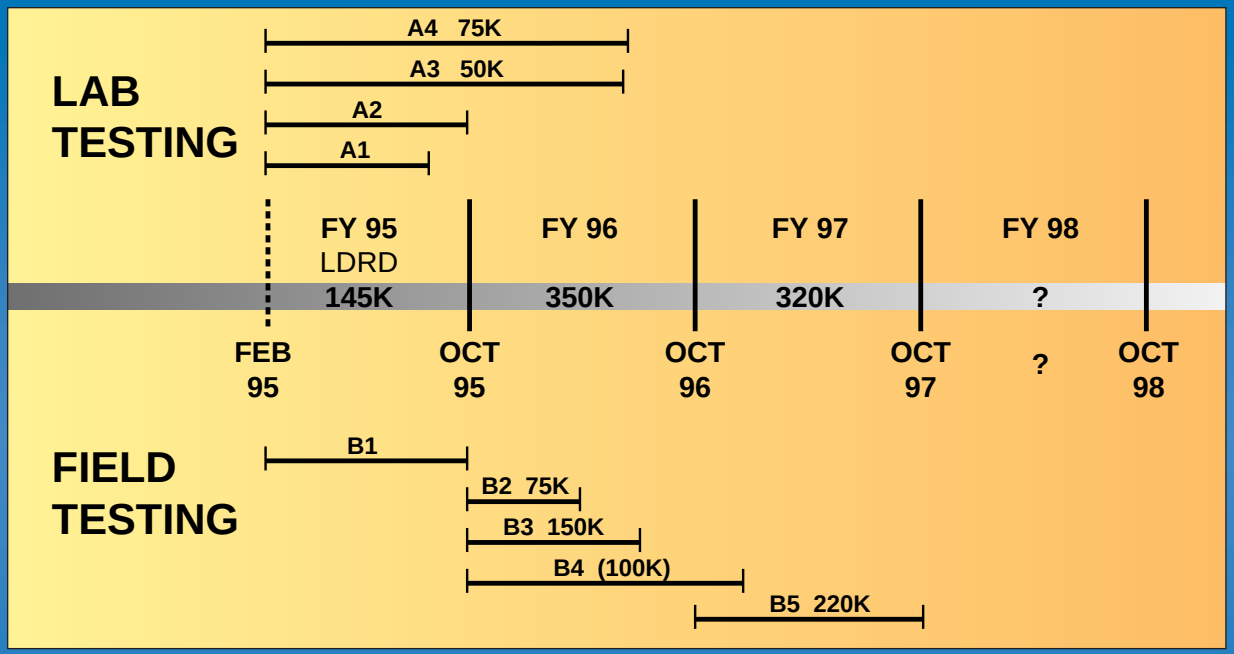
Program Life Cycle Planning



MILESTONES

- A1 Lab chamber for parallel studies developed
- A2 Required cell density determined
- A3 Moisture/nutrient concentrations optimized (50K)
- A4 Measurement system (rate of progress) developed (75K)

DECISION POINT MILESTONES

- B1 Site selected and field study initiated
- B2 Pre-determined cell density achieved (75K)
- B3 Progress measurement system developed and Implemented (75K)
- B4 Optimum surface removal rate achieved (100K)
- B5 Debris collection demonstrated (220K)

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Appendix

Potential Applications

- U.S. and international government facilities
- Reactor accidents
- Contaminated concrete reactor surfaces
- Concrete structures contaminated with mine tailings
- Storage ponds, sumps, and trenches
- Fuel handling and storage facilities
- Countless other applications

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Contamination Sources and Occurrence

- Uranium, plutonium, and fission products
- Nuclear fuel reprocessing, uranium and plutonium processing, and nuclear reactors
- Four most prominently mentioned DOE facilities:
  - INEL
  - Savannah River
  - Hanford
  - Oak Ridge

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Baseline Technologies

- Current technologies include:
  - Shot Blasting
  - Mechanical scabbling
  - Detergent scrubbing
  - Chemical and electrochemical treatment
  - Vacuuming
  - Use of jack hammers
  - Complete dismantling and removal
  - Acid treatment
- Labor requirements
  - Minimum of three laborers

Costs to Perform Baseline Technologies

- Average cost of $10 - $20 per square foot not including costs for:
  - Radiation control
  - Administration
  - Documentation
- Final costs of $50 - $60 per square foot
- Decontamination costs rise significantly when entire structure is removed
  - Increased labor
  - Increased waste volume disposal
- Additional costs associated with failed treatment
  - Characterization of missed hot spots
  - Costs to repeat the process

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Health Risks Imposed by Baseline Technologies

- Physical methods impose:
  - Increased potential for worker exposure to radioactive contamination
  - Airborne radioactive contamination
  - Increased industrial accident potential

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Waste Volume Resulting From Baseline Technologies

- Entire structures are often classified as radioactive waste while radioactivity is actually contained in the outer few mm of surface material

  Example: INEL's facility at RWMC structures are cut up into large pieces, classified, and removed as radioactive waste

- Volume increased by removing and mixing with clean concrete

- Secondary waste stream from decontamination solutions

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